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Predictions of the Atlantic meridional overturning circulation at 26.5°N within two MPI-ESM decadal climate prediction systems

Vasco Müller (1,3), Holger Pohlmann (2), Daniela Matei (2), Jochem Marotzke (2), Wolfgang A. Müller (2), and Johanna Baehr (1)

(1) University of Hamburg, Institute of Oceanography, Bundestr. 53, 20146 Hamburg, Germany, (2) Max Planck Institute for Meteorology, Bundesstr. 53, 20146 Hamburg, Germany, (3) University of Bremen, Institute of Environmental Physics, Department of Oceanography, Otto-Hahn-Allee, 28359 Bremen, Germany

We analyze the predictive skill for the Atlantic meridional overturning circulation (AMOC) and its components at 26.5°N in decadal predictions with the coupled model MPI-ESM. Predictive skill for the AMOC for up to 4 years was found in a previous model version (ECHAM5/MPIOM) using RAPID/MOCHA observations until December 2009. Here, we expand this analysis to the new model and extended observations until October 2012. We use sets of hindcasts that are initialized with two different methods: (i) ocean initialization obtained from forcing an ocean model with the NCEP-NCAR atmospheric reanalysis (baseline-0) and (ii) coupled initialization from the ORAS4 ocean reanalysis and the ERA-Interim atmospheric reanalysis (baseline-1). The initialized hindcasts for all components have higher predictive skill in the baseline-1 system than in the baseline-0 system. For the first lead year, skill arises mainly from the Ekman transport and the geostrophic upper-mid-ocean transport. For lead years 2-5, the geostrophic transport is the main source of predictive skill. Even though the separation between upper-mid-ocean transport and Florida Strait transport is somewhat ambiguous in our 1.5°-resolution setting, the robust physics of the seasonal behavior of the upper-mid-ocean transport in the coupled model and its influence on the AMOC annual cycle is an important source of predictive skill. Overall, we show that MPI-ESM is able to predict the total AMOC for five years with skill that outperforms the model's own reference climatology.